Original Article
EPIDEMIOLOGY/GENETICS

Obesity

Obesity and Associated Adverse Health Outcomes Among US Military Members and Veterans: Findings from the Millennium Cohort Study

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Objective: To assess the prevalence of obesity and associated health outcomes among US service members and veterans.

Methods: Data from three survey cycles (2001–2008) of the Millennium Cohort Study were used to examine the prevalence of obesity and associated health outcomes.

Results: Of the 42,200 individuals, 25% were of normal weight in 2007/2008. Rates of obesity were significantly higher among veterans (32%) compared with service members (20%). Over a 7-year period, obesity rates doubled among both service members (10%–20%) and veterans (14%–32%). Participants with obesity were significantly more likely to be male, older, less educated, in the Army or Navy, and separated/retired from the military. Hypertension, diabetes, and sleep apnea were significantly more common among individuals with obesity compared with participants with normal weight (all $P < 0.05$). Individuals with obesity also had significantly higher rates of depression and post-traumatic stress disorder than individuals with normal weight and had lower mental and physical functional scores (all $P < 0.05$).

Conclusions: These findings indicate an urgent need to enhance strategies for preventing and reducing excess weight gain within the military and veteran populations. Such strategies should aim to ensure a fit military force and promote health after military service.

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Introduction

Obesity has become a national health crisis, with a nearly threefold increase in prevalence (13%–36%) among the US general population in the past decades (1,2). The consequences of obesity are multiple, including adverse health outcomes, premature death, and associated societal and psychosocial costs (3,4). Although weight and body composition standards must be met for accession and retention in the US military, the military may not be immune to the ongoing obesity epidemic. Most national data on obesity are obtained through surveys of the general population, such as the Behavioral Risk Factor Surveillance System (5) and the National Health and Nutrition Examination Survey; however, these surveys do not specifically sample military personnel. Data on obesity among active duty military personnel have largely been derived from serial cross-sectional surveys [i.e., the Department of Defense (DoD) Survey of Health Related Behaviors Among Active Duty Military Personnel] (6,7), while veteran data have often relied on substudies using the Behavioral Risk Factor Surveillance System (8,9). While some studies have suggested that military members may have lower rates of obesity compared with the general population (10), a recent study indicated that the prevalence of overweight and obesity rose from 50.6% to 60.8% among active duty service members between 1995 and 2008 (7); however, these data were collected using serial cross-sectional surveys and did not evaluate the same cohort over time. A prospective investigation of body weight over time among a sample of service members and veterans followed longitudinally, examining factors associated with overweight/obesity, is needed.

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Knowledge regarding the patterns of weight gain among service members is not only important for understanding health and fitness of the military force, but also the impact on society since military members and veterans make up approximately 13% of the adult US population (9). Hence, data on the prevalence and associated factors of obesity among military populations are needed for informing both military-specific and national preventive and health care programs. We utilized data from the largest prospective study in US military history, the Millennium Cohort Study, to describe the prevalence of obesity among current and former service members over time and to assess cross-sectional associations with health outcomes.

Methods

Study population

Designed to prospectively evaluate the health impact of serving in the military, the Millennium Cohort Study launched in 2001 and includes members from all service branches and components. The first panel of the study was a probability-based sample of the entire military population. Participants were randomly selected from US military rosters, with over-sampling of selected subgroups of interest, as previously described (11). All participants voluntarily agreed to participate and gave informed consent.

Of the 77,047 participants who enrolled in the first panel and completed a baseline survey between 2001 and 2003 (referred to as the 2001 survey cycle), 55,021 (71%) completed the first follow-up questionnaire (2004–2006; referred to as the 2004 survey cycle), and 54,790 (71%) members completed the second follow-up questionnaire (2007–2008; referred to as the 2007 survey cycle). Previous studies have found the Millennium Cohort to be a representative sample of service members not influenced to participate by poor health, and analyses on weighting for nonresponse have not identified changes in metrics for mental disorders (12,13). For this analysis, we evaluated participants who completed a baseline and two follow-up surveys in order to assess BMI changes over time using the same study population ($n = 46{,}437$). Individuals missing body weight or height data from the questionnaires were excluded ($n = 4{,}237$), yielding a total study population for the current analysis of 42,200 participants.

Data sources

The Millennium Cohort survey includes self-reported height and body weight measures from which BMI was calculated. The survey also includes a comprehensive set of mental, physical, and functional health questions. Demographic and military variables were obtained from official military personnel files from the Defense Manpower Data Center. Deployment data, including in and out of theater dates, were obtained from electronic military records. Deployment status was based on being deployed at least once in support of operations in Iraq and Afghanistan prior to completing the 2007 survey. Military separation/retirement was determined using official military personnel files provided by Defense Manpower Data Center.

BMI was categorized (14) as underweight (BMI <18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obesity (≥ 30 kg/m^2). Underweight and normal weight were combined, and referred to as normal, due to low numbers of individuals who were underweight ($<1\%$) in our cohort. BMI was calculated for each survey time point and shown over three time periods.

The associations of obesity with physical, mental, and functional health outcomes were examined using 2007 survey data. Physical health outcomes included hypertension, diabetes, sleep apnea, and coronary heart disease (CHD). For each physical health outcome, participants reported if they had been diagnosed by a doctor or health professional in the last 3 years. In addition, the total number of diagnosed medical conditions was determined by summing the number of conditions endorsed from 40 possible conditions (e.g., depression, gallstones, fibromyalgia, migraines) and were categorized as 0, 1, 2, and ≥ 3.

Mental health outcomes, which included post-traumatic stress disorder (PTSD) and depression, were based on self-report of either a professional-diagnosed condition in the past 3 years or a positive screen from a standard assessment measure on the 2007 survey. The PTSD Checklist–Civilian Version is a 17-item measure of PTSD symptoms interpreted according to the Diagnostic and Statistical Manual of Mental Disorders, 4th edition criteria. A positive PTSD screen was based on having a moderate or higher level of at least one intrusion symptom, three avoidance symptoms, and two hyperarousal symptoms (15,16). Corresponding to the Diagnostic and Statistical Manual of Mental Disorders, 4th edition, the nine items of the Patient Health Questionnaire (PHQ-9) was administered to assess depression using the following two criteria: (1) endorsement of a depressed mood or anhedonia; and (2) responding "more than half the days" or "nearly every day" to at least five of the nine items, where suicidal ideation was counted if present at all (17,18).

Current levels of stress and worry were evaluated using 10 items—including "worrying about your health" and "financial problems or worries"—scored from 0 (not bothered at all) to 2 (bothered a lot) from the PHQ (18). Categories for stress and worry were defined as low (score of <15), moderate (score of 15–18), and high (score of >18).

Functional health was assessed by the Physical Component Summary and Mental Component Summary scores that were calculated from data obtained from the Medical Outcomes Study 36-Item Short Form Health Survey, Veterans version. Higher scores for both the Physical Component Summary and Mental Component Summary represent better health (19). Continuous scores were collapsed into three categories based on approximately 1 standard deviation (SD) of the baseline scores from the mean, with "low" representing scores below the 15th percentile and "high" representing scores above the 85th percentile (20). Somatic symptoms were assessed using the PHQ 15-Item Somatic Symptom Severity Scale (PHQ-15). The PHQ-15 consists of 15 somatic symptoms scored from 0 (not bothered at all) to 2 (bothered a lot). Scores of 15 or higher (referred to as multiple somatic symptoms) have shown to be significantly associated with increased impairment and higher health care utilization (21).

Statistical analysis

Descriptive characteristics, including demographic and military covariates, were summarized and reported by BMI category using the 2007 survey data. The percentage of participants in each BMI

TABLE 1 Characteristics* by BMI category for Millennium Cohort participants at the 2007 to 2008 survey (N = 42,200)

	BMI		
	Normal[a] ($n = 10,962$), *n* (%)	Overweight ($n = 21,452$), *n* (%)	Obesity ($n = 9,786$), *n* (%)
Sex			
Male	5,914 (19.0)	17,350 (55.6)	7,923 (25.4)
Female	5,048 (45.8)	4,102 (37.3)	1,863 (16.9)
Age (years)			
≤36	3,845 (32.7)	5,577 (47.5)	2,329 (19.8)
37–42	2,443 (24.6)	5,272 (53.1)	2,214 (22.3)
43–48	2,457 (23.3)	5,316 (50.4)	2,786 (26.4)
>48	2,217 (22.3)	5,287 (53.1)	2,457 (24.7)
Race/ethnicity[b]			
Non-Hispanic white	7,878 (26.1)	15,314 (50.8)	6,941 (23.0)
Non-Hispanic black	1,081 (22.3)	2,364 (48.7)	1,407 (29.0)
Hispanic	577 (23.9)	1,242 (51.3)	600 (24.8)
Asian/Pacific Islander	1,184 (30.6)	2,087 (53.9)	600 (15.5)
Other	227 (25.6)	430 (48.5)	230 (25.9)
Marital status			
Never married	1,843 (35.1)	2,338 (44.6)	1,065 (20.3)
Married	7,655 (23.8)	16,914 (52.5)	7,623 (23.7)
Divorced, separated, widowed	1,464 (30.7)	2,200 (46.2)	1,098 (23.1)
Education			
Some college or less	5,286 (22.7)	11,806 (50.8)	6,154 (26.5)
Bachelor's degree or higher	5,676 (30.0)	9,646 (50.9)	3,632 (19.2)
Service branch			
Air Force	3,540 (28.1)	6,319 (50.2)	2,721 (21.6)
Army	4,970 (24.7)	10,290 (51.1)	4,872 (24.2)
Coast Guard	115 (24.3)	248 (52.4)	110 (23.3)
Marine Corps	425 (26.6)	896 (56.1)	276 (17.3)
Navy	1,912 (25.8)	3,699 (49.9)	1,807 (24.4)
Military component			
Active duty	6,040 (27.4)	10,830 (49.1)	5,203 (23.6)
Reserve/National Guard	4,922 (24.5)	10,622 (52.8)	4,583 (22.8)
Occupation			
Combat	1,820 (22.9)	4,375 (54.9)	1,771 (22.2)
Health care	1,871 (37.1)	2,241 (44.5)	929 (18.4)
Functional support	2,744 (29.2)	4,722 (50.2)	1,939 (20.6)
Other	4,527 (22.9)	10,114 (51.1)	5,147 (26.0)
Deployed before 2007–2008[c]			
No	6,483 (27.0)	11,636 (48.4)	5,919 (24.6)
Yes	4,479 (24.7)	9,816 (54.1)	3,867 (21.3)
Separation from the military			
No	8,527 (27.0)	16,612 (52.6)	6,423 (20.4)
Yes	2,435 (22.9)	4,840 (45.5)	3,363 (31.6)

[a]Of those in this category 210 (1.9%) were underweight.
[b]Thirty-eight individuals are missing race/ethnicity data.
[c]Includes individuals with deployment experience in support of the operations in Iraq and Afghanistan before the 2007–2008 survey date.
*All characteristics were significant at $P < 0.0001$ (χ^2 test).

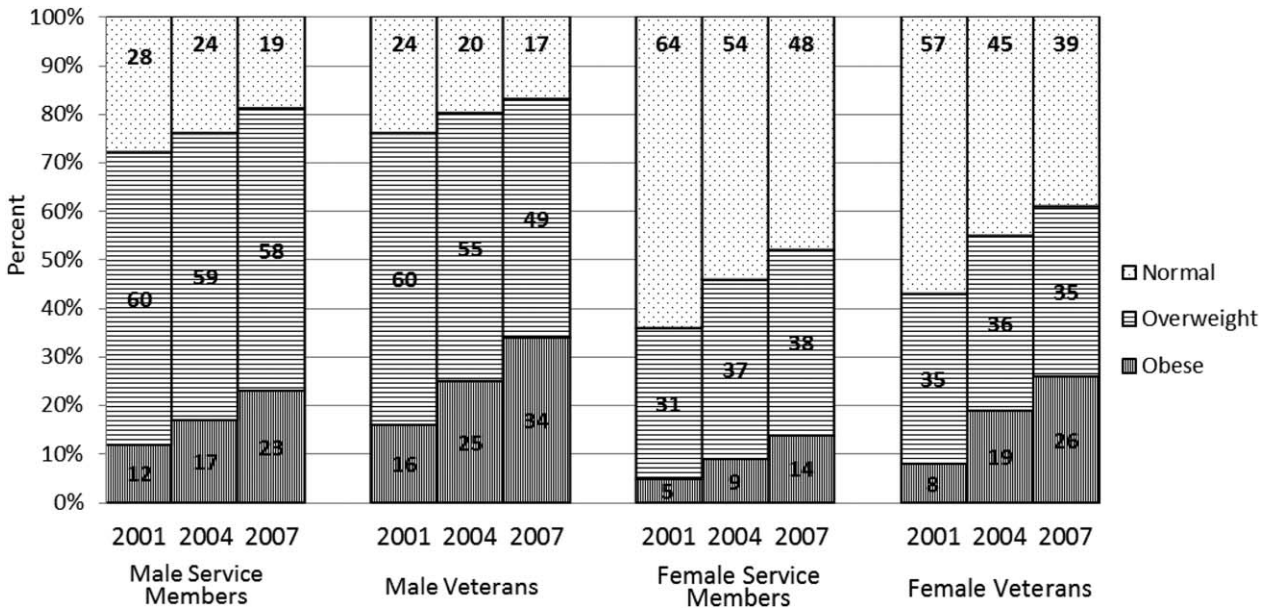

Figure 1 BMI categories by survey cycle (2001–2003, 2004–2006, 2007–2008) for study population ($N = 42{,}200$) stratified by sex and service status.

category, stratified by gender and service status (current vs. former service members were assessed at the time of completion of the 2007 survey), were calculated for each survey cycle. The mean and percent body weight change over time were calculated and described. Weights were created and applied based on the sex and gender of the US military population as of October 2000, when the population was established. Weighted unadjusted associations of BMI with health outcomes were assessed using χ^2 tests. All data management and statistical analyses were conducted using SAS version 9.3 (SAS Institute, Inc., Cary, NC).

Results

Study population characteristics and factors associated with obesity

Among the 42,200 military members and veterans at the 2007 survey, the mean (SD) age was 42 (9.0) years, 74% were male, and 71% were non-Hispanic white. Seventy-five percent were on active-duty service, while 25% had separated or retired from military service [mean (SD) time since separation/retirement = 3.8 (1.9) years]. Data from the 2007 survey demonstrated that 210 (<1%) participants were underweight, 10,752 (26%) were normal weight, 21,452 (51%) were overweight, and 9,786 (23%) had obesity.

Participants with obesity were proportionately more likely to be male, older, non-Hispanic black less educated, in the Army or Navy, nondeployers, and separated/retired from the military (Table 1). For example in 2007, 20% of current service members had obesity compared with 32% of veterans ($P < 0.001$). There was no significant change in the percentage of obesity among veterans when the time since separation from the military was divided into periods of <1 year, 1 to 3 years, and >3 years since separation (30%, 31%, and 32%, respectively), suggesting that the increase in obesity may occur close to the time of military separation.

Obesity and body weight change trends over time

The mean BMI of the study population significantly increased during the study timeframe: 26.1 kg/m^2 in 2001, 26.8 kg/m^2 in 2004, and 27.5 kg/m^2 in 2007 ($P < 0.0001$). Data, stratified by gender and service status (current vs. former service members), showed that the percentage of service members with obesity (≥30 kg/m^2) increased over time among each of the four groups, with the female and male veteran groups having the largest increases (8%–26% and 16%–35%, respectively). The percentage of service members/veterans who were of normal weight or underweight (<25 kg/m^2) diminished over time (Figure 1).

Similar to BMI changes over time, the study population had a mean (SD) body weight change of +4.1 (6.9) kg during the 2001 to 2007 study period. Overall, 35% of service members/veterans gained 3% to 10% of their body weight, while 22% gained more than 10% of their body weight between 2001 and 2007. Females and males had a mean (SD) weight increase of 4.5 (7.3) kg and 4.0 (6.8) kg, respectively.

Associations between obesity and health outcomes

In cross-sectional analysis using weighted data from the 2007 survey cycle, participants with obesity were significantly more likely to report having hypertension, diabetes, sleep apnea, and CHD, compared with individuals with normal weight (all $P < 0.001$; Table 2). Twice as many individuals with obesity reported being diagnosed

TABLE 2 Weighted[a] prevalence of self-reported physician-diagnosed medical conditions and weighted frequencies of functional health by BMI for Millennium Cohort participants, 2007–2008 survey cycle

	BMI		
	Normal[b] (%)	Overweight (%)	Obesity (%)
Medical condition*			
Hypertension[c]	7.9	15.0	27.4
Diabetes[c]	1.1	1.9	4.5
Sleep apnea[c]	2.5	5.4	13.8
Coronary heart disease[c,d]	0.7	1.1	1.7
No. medical conditions[e]			
0	54.4	51.3	37.1
1	23.4	23.3	24.7
2	10.7	11.8	14.7
≥3	11.5	13.7	23.5
PTSD[f]	7.4	7.2	11.8
Depression[f]	10.3	9.6	15.5
Multiple somatic symptoms[g]	2.3	2.2	5.1
Functional health*			
Mental component summary score[h]			
Low	16.2	15.0	20.1
Moderate	71.2	71.4	66.9
High	12.7	13.5	13.0
Physical component summary score[h]			
Low	10.1	12.7	21.3
Moderate	67.4	71.7	70.6
High	22.5	15.7	8.1
Life stress/worries[i]			
Low	38.7	34.2	21.0
Moderate	41.8	43.8	45.3
High	19.5	22.0	33.7

[a]Sample was weighted to US military population in October 2000.
[b]Of those in this category 210 (1.9%) were underweight.
[c]Self-reported physician-diagnosed medical conditions in "past 3 years."
[d]Coronary heart disease included heart attack diagnosis.
[e]Self-reported physician-diagnosed conditions included: anemia, angina, asthma, cancer, chronic fatigue, chronic bronchitis, cirrhosis, coronary heart disease, Crohn's disease, depression, diabetes, emphysema, fibromyalgia, gallstones, hearing loss, heart attack, hepatitis B, hepatitis C, hepatitis other, hypertension, kidney failure, lupus, manic depression, migraine, multiple sclerosis, neuropathy, other heart diagnosis, pancreatitis, PTSD, rheumatoid arthritis, schizophrenia, seizure, sinusitis, sleep apnea, stroke, thyroid condition, ulcer, vision loss, ulcerative colitis, and urinary tract infection.
[f]PTSD and depression included both self-reported physician diagnosis and screening data from the PHQ-9 (depression) and PCL-C (PTSD) using DSM-IV criteria.
[g]Positive screen is a PHQ-15 score of ≥15.
[h]Computed using the Medical Outcomes Study 36-Item Short Form Health Survey, Veterans version (SF-36V) with "low" and "high" representing scores below the 15th and above 85th percentile, respectively.
[i]Life stress and worries were assessed using screening data from the Patient Health Questionnaire, which includes questions concerning worries about appearance, finances, health, and family. Those with a "low" score have lower levels of worry/stress.
*All characteristics were significant at $P < 0.0001$ (χ^2 test).
DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4th Edition; PCL-C, Patient Checklist–Civilian Version; PHQ-9, Patient Health Questionnaire-9; PHQ-15, Patient Health Questionnaire 15-Item Somatic Symptom Severity Scale; PTSD, post-traumatic stress disorder.

with ≥3 medical conditions compared with normal weight individuals (24% vs. 12%; $P < 0.001$; Table 1). Participants with obesity were also more likely to screen positive for mental health conditions, including depression and PTSD ($P < 0.0001$), and multiple somatic symptoms ($P < 0.0001$; Table 2). Finally, those with obesity had lower mental and physical functional health scores, and more self-reported life stressors/worries compared with normal weight individuals (all $P < 0.0001$; Table 2).

Discussion

This study provides data on obesity trends among military service members and veterans, indicating a doubling of the prevalence between 2001 and 2007. Although the prevalence of obesity was lower among service members compared with the general US population (2007: 20% vs. 34%) (1), veterans had a nearly identical rate (32%), demonstrating the propensity for excessive weight gain around the time of leaving the military. This study also demonstrated an association between obesity and numerous adverse physical, mental, and functional health outcomes in this relatively young cohort. The high prevalence of obesity and associated adverse health effects indicate the need to enhance strategies for preventing excess weight gain within military and veteran populations.

Our study demonstrated that military personnel, even during service time, are susceptible to weight gain and development of obesity. Data from the DoD Survey of Health Related Behaviors showed that obesity increased from 9% to 13% between 2002 and 2005 and remained elevated (13% in 2008) (6,7). Our study confirmed this rising trend using confidential survey data and demonstrated a continuing rise in prevalence of obesity among current service members (10% in 2001–2003, 15% in 2004–2006, and 20% in 2007–2008).

Findings from our veteran sample provide an even more concerning trend—despite being out of the service for only a mean of 3.8 years, veterans had a similar prevalence of obesity compared with the general population. Previous studies also demonstrated that veterans have similar or higher rates of obesity compared with nonveterans, but these studies often evaluated individuals long after leaving military service (8,9,22-24). Previous findings from the Millennium Cohort suggest that veterans often gain excess weight near the time of discharge, thus highlighting a critical time for the implementation of preventive strategies (25). This association between weight gain and separation from the military indicates that having served in the US military does not protect against subsequent obesity—perhaps some of this may be a result of the military's weight maintenance programs (including mandatory biannual weight checks and fitness testing) being based on negative consequences rather than the internalization of standards for healthy living.

Our data also revealed an increasing prevalence of obesity among veterans over the past decade. A study of veterans in 2004 showed that 25% of male and 21% of female veterans with obesity (8), and our data showed a continued progression of these obesity rates (25%–34% for male veterans and 19%–26% for female veterans in 2004–2006 and 2007–2008, respectively). These data are important for the overall health of the nation, as military personnel (in particular veterans) comprise a sizable proportion of the US population, with a notable increase in the number of veterans since the Iraq and

Afghanistan conflicts (3,22). These study findings demonstrate high obesity rates in veterans despite having experienced both environmental and cultural factors that promote healthy body weight while in the military.

Excessive body weight does not exist in isolation, but has important consequences for the health and well-being of the individual. Despite evaluating a young, otherwise healthy, population, this study demonstrated significant relationships between obesity and several physical health outcomes, including hypertension, diabetes, CHD, and sleep apnea. In prior studies using Millennium Cohort data, many of these outcomes were significantly associated with obesity (e.g., diabetes, CHD, Achilles tendinitis, and plantar fasciitis) after adjustment for demographic, behavioral, and military characteristics (26-28). Other studies in the general population have identified other physical health conditions that have been associated with obesity, including dyslipidemia, osteoarthritis, and certain types of cancers (e.g., endometrial, breast, colon) (4,29,30).

Similar to previous studies, our study also showed significant cross-sectional relationships between obesity and mental health conditions, including depression and PTSD (3,31,32). Using data from the Millennium Cohort Study, a recent study found that PTSD was associated with a subsequent 3-year weight gain and the development of obesity (33). Mental health illnesses may result in unhealthy dietary habits in response to stress or emotional regulation; poor physical activity habits; use of medications that cause weight gain; and/or neuroendocrine changes that contribute to obesity. It is also possible that obesity may predispose to the development of mental health conditions (5).

Although several studies in the general population have described demographic groups at highest risk for obesity, military data are more limited. Our study found that female service members and veterans were less likely to have obesity than their male counterparts. This contrasts with national data showing that, in 2007 to 2008, 36% of women had obesity compared with 32% of men (34). Although, women may under-report their body weight and may have higher body fat than demonstrated by BMI (35), these factors likely do not explain the differences in obesity between military and civilian women. It is possible that females who have joined the military have specific attributes toward physical fitness and weight maintenance compared with their civilian counterparts.

Similar to other studies, we found that increasing age was associated with obesity (5,6), which may be the result of progressive accumulation of small weight increases over time. We also found that blacks had higher rates of obesity despite having similar access to health care and food services within the military setting.

Regarding military-specific characteristics, those in a health care occupation and prior deployers were proportionally less likely to have obesity. The Army and Navy had a higher prevalence of obesity, while the Marine Corps had the lowest, similar to results of DoD surveys (36). Further examination showed that the percentage of obesity was lower in each age category for the Marines, indicating that there are likely service-related differences. The types of people who join and type of work performed in each service may contribute to different rates of obesity. For example, rates of obesity by the service branch may be related to differences in behaviors, such as smoking and exercise habits.

Obesity's impact on the military has been described as a national security risk (37). The obesity epidemic has affected the number of eligible recruits (38) as the military recruits come from a population with increasing obesity rates. After military entry, excess weight contributes to early discharges prior to completion of service term, amounting to costs of $60 million per year (37). Among those who remain in service, obesity may negatively affect career progression (e.g., promotion or selection for professional military schools) and deployability. Finally, there are additional costs associated with service-connected disabilities, decreased productivity, absenteeism, and premature mortality (5).

While the military and veteran leaders are currently addressing many of the concerns mentioned above, the present data are important for informing programs and policies that specifically aim to address obesity and overall health behaviors among US service members and veterans. For example, the Performance Triad implemented by the US Army Surgeon General addresses some of these issues by using public health initiatives that focus on quality sleep, activity engagement, and improved nutrition (see www.armymedicine.mil for more information). In addition, other DoD programs (e.g., Operation Live Well) focus on active lifestyles and healthy eating habits (see www.health.mil/livewell). Such programs may benefit from this study's findings, in conjunction with other research, to strengthen their program aims and goals. Military service time and transition out of the military represent critical times for establishing lifelong healthy behaviors, which could not only ensure a fit force but also reduce post-service-related costs for the DoD, Department of Veterans Affairs, and US health care system, as well as enhance the quality of life for thousands of veterans.

Several study limitations should be noted. We utilized self-reported data provided on confidential surveys, which may misclassify some individuals due to misreporting weight and height measurements (39). However, when self-reported weight from the Millennium Cohort questionnaire was compared with fitness records within 60 days of each other among a sample of Air Force personnel, 75% reported weight within 3% of the weight recorded on their fitness record. We utilized BMI as an estimate of body fat, but this measure may be influenced by muscle mass. For this article, our research team specifically focused on obesity; however, we also reported weight changes (kg) over time. Researchers have found that BMI is an adequate measure to assess excessive weight and its associated morbidities in population studies (5,40).

Another potential limitation is that we evaluated military members who were in the service during 2000; hence, our study did not include more recent military accessions. However, this approach allowed for longitudinal assessments of BMI trends among service members and veterans utilizing the same population—a notable limitation of prior studies (6,10). In addition, it was not possible to assess weight change in survey nonresponders who were generally younger, less educated, and more likely to have left the military (13); such characteristics may have underestimated obesity rates in our study. While our study population may not be representative of the overall military or veteran population, analyses were weighted based on the age and sex of the overall military population. The reported prevalence rates are unadjusted, which could overestimate or underestimate obesity in some groups by not adjusting for variables such as smoking and physical exercise. Finally, our study examined the cross-sectional associations of BMI and various health

outcomes; future longitudinal studies that examine the trajectories of body weight over time and long-term health outcomes are planned.

In summary, this is the first study to prospectively follow a large cohort of military members and veterans during 2001 to 2007 and describe obesity trends and associated health outcomes. Although active duty military members were less likely to have obesity compared with civilians, this rapidly reversed after separation from military service, with veterans being as likely to have obesity as civilians. These results can be used to inform both DoD and Veterans Affairs leadership of the current obesity rates and trends in both service member and veteran populations. Given the associations of obesity with multiple adverse physical, mental, and functional health outcomes in this relatively young cohort, body weight management strategies should stand as a DoD and national priority.O

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14. ABSTRACT

Objective: To assess the prevalence of obesity and associated health outcomes among US service members and veterans.
Methods: Data from three survey cycles (2001–2008) of the Millennium Cohort Study were used to examine the prevalence of obesity and associated health outcomes.
Results: Of the 42,200 individuals, 25% were of normal weight in 2007/2008. Rates of obesity were significantly higher among veterans (32%) compared with service members (20%). Over a 7-year period, obesity rates doubled among both service members (10%–20%) and veterans (14%–32%). Participants with obesity were significantly more likely to be male, older, less educated, in the Army or Navy, and separated/retired from the military. Hypertension, diabetes, and sleep apnea were significantly more common among individuals with obesity compared with participants with normal weight (all $P<0.05$). Individuals with obesity also had significantly higher rates of depression and post-traumatic stress disorder than individuals with normal weight and had lower mental and physical functional scores (all $P<0.05$).
Conclusions: These findings indicate an urgent need to enhance strategies for preventing and reducing excess weight gain within the military and veteran populations. Such strategies should aim to ensure a fit military force and promote health after military service.

15. SUBJECT TERMS

obesity, weight, health outcomes, prospective study, military, veteran, epidemiology

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